ACADEMIC ACHIEVEMENT PREDICTION MODEL USING NEURAL NETWORKS

A thesis submitted to the Graduate School in partial fulfillment of the requirements for the degree Master of Science(Information Technology), Universiti Utara Malaysia

by
Normaziah Binti Abdul Rahman

Sekolah Siswazah
(Graduate School)
Universiti Utara Malaysia

PERAKUAN KERJA KERTAS PROJEK
(Certification of Project Paper)

Saya, yang bertandatangan, memperakukan bahawa
(I, the undersigned, certify that)

NORMAZIAH BINTI ABDUL RAHMAN

calon untuk Ijazah
(candidate for the degree of) Master of Science (Information Technology)

telah mengemukakan kertas projek yang bertajuk
(has presented his/her project paper of the following title)

ACADEMIC ACHIEVEMENT PREDICTION MODEL USING NEURAL NETWORKS

seperti yang tercatat di muka surat tajuk dan kulit kertas projek
(as it appears on the title page and front cover of project paper)

bahawa kertas projek tersebut boleh diterima dari segi bentuk serta kandungan, dan meliputi bidang ilmu dengan memuaskan.
(that the project paper acceptable in form and content, and that a satisfactory knowledge of the field is covered by the project paper).

Nama Penyelia
(Name of Supervisor) : Prof. Madya Fadzilah Siraj

Tandatangan
(Signature) :

FADZILAH SIRAJ
Associate Professor
School of Information Technology
Universiti Utara Malaysia

Tarikh
(Date) : 23/05/2002

PERMISSION TO USE

In presenting this thesis in partial fulfillment of the requirement for a post graduate degree from Universiti Utara Malaysia, I agree that the University Library may make it freely available for inspection. I further agree that permission for copying of this thesis in any manner, in whole or in part, for scholarly purposes may be granted by my supervisor or, in their absence, by the Dean of the Graduate School. It is understood that any copying or publication or use of this thesis or parts thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and Universiti Utara Malaysia for any scholarly use which may be made of any material from my thesis.

Requests for permission to copy or to make other use of materials in this thesis, in whole part, should be addressed to :

Dean of Graduate School
Universiti Utara Malaysia
06010 UUM Sintok
Kedah Darul Aman

ABSTRACT (BAHASA MELAYU)

Kajian ini bertujuan untuk membangunkan model ramalan pencapaian akademik(ACP) berasaskan rangkaian neural. Ia mampu untuk meramalkan keputusan peperiksaan pelajar bagi kursus Pengaturcaraan I (Bahasa C) di Kolej Agama Sultan Zainal Abidin (KUSZA), Kuala Terengganu. Model ini membenarkan pentadbir sistem untuk melatih dan menormalisasi data. Setelah model ini telah dilatih dan disahkan oleh pentadbir sistem ini, pencapaian pelajar boleh diramalkan pada masa depan. Model ini boleh meramalkan keputusan kursus pengaturcaraan I berdasarkan latarbelakang pendidikan pelajar semasa peperiksaan Sijil Pelajaran Malaysia (SPM).

Penyelesaian berasaskan rangkaian neural dengan menggunakan *Multi Layer Perceptron* (MLP) dan algoritma rambatan balik telah digunakan di dalam pembangunan model ini. Sejumlah 248 sampel data telah dikutip daripada pelajar Diploma Teknologi Maklumat dan Multimedia dan sampel ini telah dilatih dan diuji menggunakan model ini. Ketepatan ramalan bagi latihan sebanyak 90% dan ujian sebanyak 83.33% telah dicapai menggunakan model ini.

Analisa data menunjukkan terdapat hubung-kait antara pembolehubah input, yang mana ia terdiri daripada umur, jantina, lokasi sekolah, aliran pelajaran dan keputusan untuk matapelajaran tertentu iaitu English, matematik, Sains, Fizik dan Matematik Tambahan, dengan pembolehubah output. Keputusan juga menunjukkan rangkaian neural mempunyai potensi di dalam bidang pendidikan.

ABSTRACT (ENGLISH)

This study aims to develop the academic achievement prediction (ACP) model using Neural Networks. It is capable of predicting the student's result in Programming I (C Language) subject for Kolej Agama Sultan Zainal Abidin, Kuala Terengganu. This model allows the system administrator to train and normalize data as well as trains. Once the model has been established by the administrator, the future student achievement can be forecast by the model. The system can predict the result of Programming I subject based on the student 's background during the Sijil Pelajaran Malaysia (SPM) examination.

A neural network technique, using Multi Layer Perceptron (MLP) and back propagation algorithm was employed. A total of 248 data samples from Information Technology and Multimedia Diploma students were collected, trained and tested using this model. A training prediction of 90 % accuracy and testing prediction of 83.33% accuracy were achieved using this model.

The analysis of the data shows a reasonably strong correlation between the input variables, which consist of age, gender, school location, subject stream and result for a certain subjects: English, Mathematics, Science, Physics and Additional Mathematics, with the targeted output variable. The results also indicate that neural network has a potential to be used for education planning.

ACKNOWLEDGEMENTS

Throughout this project, I was fortunate to have had the help and contributions of my supervisors, Prof. Madya Fadzilah Siraj. I would like to extend my thanks to my beloved husband, Fazli and my daughter, Aisyah for the courage and understanding. This project would not been possible without their encouragement, support and guidance.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 Introduction

As technology continuously progresses, methodologies evolve to enhance our abilities to perform arduous tasks more expediently. Utilizing modern computing technologies not only makes completing tasks more efficient, but also often achieves a higher degree of accuracy than do humans. Neural network has emerged as a very popular area of research, both from the design and the usage points of view. There is considerable research emphasis on designing better and more efficient neural networks, more powerful "learning algorithms", better transfer functions. On the other hand, there is a great amount of academic interest in the applications of neural networks. In addition, there is a significant volume of research on neural networks in the engineering and science literature. There also exists a reasonable body of neural network research as related to business.

The contents of the thesis is for internal user only

REFERENCES:

A.Cripps. (1996). "Predicting grade point average using clustering and ANNs". *Proceedings of World Congress on Neural Networks*, 486-490.

Alina Andreica. (2001). "Web-based Expert System for Distance Education." URL : http://www.euro.ubbcluj.ro/en/rel/grant3.htm

Barton, K., Dielman, T. E., & Cattell, R. B. (1972). " Personality and IQ measures as predictors of school achievement ". Journal of Educational Psychology, 63, (4), 398-404

Black,William. (1998). "Raising standards through classroom assessment.". London : King College of London.

Brian R. Gaines.(2001). "Modeling and Forecasting the Information Sciences." URL : http://ksi.cpsc.ucalgary.ca/articles/BRETAM/InfSci/

C. Van Nelson dan L.W. Henriksen.(1994)."Using neural net technology to enhance the efficiency of a computer adaptive testing application". Mid – Western Educational Research Association annual Meeting, 1 – 40.

Coleman, J. S., E. Q. Campbell, C. J. Hobson, J. McPartland, A. M. Mood, F. D. Weinfeld, and R. L. York. 1966. "Equality of educational opportunity ". Washington, D.C.: U.S. Government Printing Office.

Darling-Hammond, L.(2000). "Teacher quality and student achievement: A review of state policy evidence ". Education Policy Analysis Archives 8 (1).

David McArthur.(2000). "Some Possible Futures For Artificial Intelligence In MathematicsEducation".URL : http://www.rand.org/education/mcarthur/Papers/future.html

Hardgrave, B.LC., Wilson, R.L dan Walstrom, K.A. (1994). "Predicting Graduate Student Success: A Comparison of Neural Networks and Traditional Techniques". *Computers and Operational Research*, 21(3): 249-263.

John Beasley (2001). "Operations Research Notes". URL : http://mscmga.ms.ic.ac.uk/jeb/or/contents.html

Michael J. Fine *et. al.* (1997). " Pneumonia: New Prediction Model Proves Promising" New England Journal of Medicine.

Mukarani, K. dan Taguchi, A.(1991)."Gesture recognition using recurrent neural Network ". Paper presented at the CH1191: Human factors in computing system conference.

Odom, M. dan Sharda, R. (1994). "A Neural Network Model for Bankruptcy Prediction". Oklahoma State University. Unpublished Manuscript .

Raha Yahya. (1991). "Korelasi antara Status Sosio-ekonomi Keluarga Pelajar, Bentuk Stail Kognitif dan Pencapain Akademik Pelajar dalam Sains dan Matematik". Tesis M.Ed. UKM, Bangi.

R. Beale and J. Finlay .(1989). "User modelling with a neural system". Technical Report YCS1 18, Department of Computer Science, University of York, I-leslington, York, England,

Schnaars, S.P. (1989). "Megamistakes: Forecasting and the Myth of rapid Technological Change". New York, Free Press.

Sepian, N.W. (1981). "Conception Educational Achievement". Educational Researcher: Vol. 19, No. 3.

Shute, V., R. Glaser, and K. Raghaven. (1989). "Inference and Discovery in an Exploratory Laboratory". Learning and Individual Differences. pp. 279-326.

Siegelmann, H.T. (1998)." Neural Networks and Analog Computation: Beyond the Turing Limit". Boston: Birkhauser, ISBN 0-8176-3949-7.

Steve Beveridge. (2001)." Forecasting for Planners and Managers " URL: http://courses.bus.ualberta.ca/mgtsc405-beveridge

Susan M. Colaric, A. J. Turgeon and David H. Jonassen. (2001). "A Web-Based Case Library to Support Learning". URL : http://www.personal.psu.edu/staff/s/m/smc258/KB/CBRarticle.htm

Turbant, E. (1992). "Expert Systems and applied Artificial Intelligence". New York: MacMillan Publication Co.

V. Carbone dan G. Piras. (1998). " Palomar project : Predicting school renouncing dropouts, using the artificial neural networks as a support for educational policy decisions". Subtance Use and Misuse, 33(3), 717-750.

Valley.K. (1990). "The Use of Expert System Shells in Education: an Explanation-Based Approach ."

Wallman, B.B. (1973). "Dictionary of Behavioral Science". New York: Van Nostrand Reintold Company.

W.L. Gorr, D. Nagin dan J.Szczypula.(1994). " Comparative study of artificial neural network and statistical models for predicting student grade point averages". *International Journal of Forecasting*, 10(2), 17-34.

Winston, P.H. (1977). "Reading, Mass.curriculum as an educational medium". Artificial Intelligence, Addison-Wesley Pub.